



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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9231/42

October/November 2022

1 hour 30 minutes

You will need: List of formulae (MF19)

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1** A basketball club has a large number of players. The heights, x m, of a random sample of 10 of these players are measured. A 90% confidence interval for the population mean height, μ m, of players in this club is calculated. It is assumed that heights are normally distributed. The confidence interval is $1.78 \leq \mu \leq 2.02$.

Find the values of $\sum x$ and $\sum x^2$ for this sample.

[6]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- 2 In the colleges in three regions of a particular country, students are given individual targets to achieve. Their performance is measured against their individual target and graded as ‘above target’, ‘on target’ or ‘below target’. For a random sample of students from each of the three regions, the observed frequencies are summarised in the following table.

		Region			Total
		<i>A</i>	<i>B</i>	<i>C</i>	
Performance	Above target	62	41	44	147
	On target	102	94	95	291
	Below target	56	45	61	162
	Total	220	180	200	600

Test, at the 10% significance level, whether performance is independent of region. [7]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.

- 3 A scientist is investigating the masses of birds of a certain species in country X and country Y . She takes a random sample of 50 birds of this species from country X and a random sample of 80 birds of this species from country Y . She records their masses in kg, x and y , respectively. Her results are summarised as follows.

$$\Sigma x = 75.5 \quad \Sigma x^2 = 115.2 \quad \Sigma y = 116.8 \quad \Sigma y^2 = 172.6$$

The population mean masses of these birds in countries X and Y are μ_x kg and μ_y kg respectively.

Test, at the 5% significance level, the null hypothesis $\mu_x = \mu_y$ against the alternative hypothesis $\mu_x > \mu_y$. State your conclusion in the context of the question. [8]

[illegible]

- 4 The continuous random variable X has probability density function f given by

$$f(x) = \begin{cases} k & 0 \leq x < 1, \\ kx & 1 \leq x \leq 2, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

- (a) Show that $k = \frac{2}{5}$. [1]

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- (b) Find the interquartile range of X . [5]

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(c) Find $\text{Var}(X)$.

[4]

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- 5** A 6-sided dice, A , with faces numbered 1, 2, 3, 4, 5, 6 is biased so that the probability of throwing a 6 is $\frac{1}{4}$. The random variable X is the number of 6s obtained when dice A is thrown twice.

(a) Find the probability generating function of X . [2]

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A second dice, B , with faces numbered 1, 2, 3, 4, 5, 6 is unbiased. The random variable Y is the number of 6s obtained when dice B is thrown twice.

The random variable Z is the total number of 6s obtained when both dice are thrown twice.

(b) Find the probability generating function of Z , expressing your answer as a polynomial. [3]

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(c) Find $\text{Var}(Z)$.

[3]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.

(d) Use the probability generating function of Z to find the most probable value of Z .

$$[1]$$
[illegible]

- 6 The manager of a technology company A claims that his employees earn more per year than the employees at technology company B . The amounts earned per year, in hundreds of dollars, by a random sample of 12 employees from company A and an independent random sample of 12 employees from company B are shown below.

Company <i>A</i>	461	482	374	512	415	452	502	427	398	545	612	359
Company <i>B</i>	454	506	491	384	361	443	401	472	414	342	355	437

- (a) Carry out a Wilcoxon rank-sum test at the 5% significance level to test whether the manager's claim is supported by the data. [9]

[illegible]

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- (b) Explain whether a paired sample t -test would be appropriate to test the manager's claim if earnings are normally distributed. [1]

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